

# Utilizing Earned Value Management for Tracking and Predicting the Performance of Ibi Bridge Project in Nigeria

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## ABSTRACT

Many construction projects in developing Nations including Nigeria suffer from time and cost overruns. Construction sectors are supposed to play a significant role in providing social infrastructure in an innovative and cost-effective manner. Over the years as technology and engineering keep evolving, construction is becoming more complex and sophisticated hence, the importance of managing projects, especially large scale and mega projects cannot be overemphasized. Oftentimes Scope creep, time and cost overruns are three common problems in construction project where there is no proper project management approach. This has greatly affected many projects in Nigeria causing them to be abandoned. Although project cost variations may occasionally be unavoidable owing to inflation and other unforeseeable circumstances, lack of proper planning and design have also made it difficult to create accurate projections of the cost of materials and the overall project's expense. This research aims at utilizing Earned Value Management (EVM) for tracking and predicting the performance of Ibi bridge project to address the common problems of construction project in Nigeria such as cost overruns that leads to abandonment of many projects. The study research employed a survey using questionnaires, interviews for data collection. The questionnaires were aimed at getting an in-depth knowledge of EVM in Nigeria. Also, a case study design was employed whereby Ibi Bridge project was used as a sample to collect data. The data were processed using Microsoft Excel, ANOVA, and Earned Value Analysis (EVA) were used to analyze the data. From the case study analysis, the Cost Performance Index (CPI) and Schedule Performance Index (SPI) turned out to be 0.88 and 0.34 respectively showing that the project is behind schedule and over budgeted. There could be some outstanding setbacks that could have contributed to this. The earned value management technique acts as a trigger warning, demonstrating how severely these setbacks can affect the project if they are not properly managed. The research recommends that professional organizations in Nigeria need to educate their members on the benefits of employing EVM by holding workshops, lectures, and conferences on the subject and government bodies should employ the technique more in construction projects in Nigeria.

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## 1.0 Introduction

Through analysis of previous research, the literature review typically offers a thorough look at the fundamental components of the field of study. The literature to be examined will be similar but not limited to; The utilization of Earned value methodology for tracking and predicting the performance of Ibi Bridge project, concepts, implementations and challenges EVM. Setting a plan for the data collecting and analysis methods necessary to accomplish the goals of this study and provide answers to the research questions will be made easier with the knowledge gained from earlier research projects.

The concept of "earned value" has been around for over four decades, if not more than a century, proving its efficacy as a

system for managing and controlling projects by tying together such variables as timeframe, budget, and "physical progress" [1, 2]. Earned Value Management (EVM) is a project management technique used for analyzing the economic and operational success of a given endeavour. This method generates a single statistic called Earned Value (EV) by combining time and cost data. Construction/Project managers can apply EVM as a method that monitors how well their projects are doing in comparison to the base-lines they've established which helps to identify potential risks and hazards. In addition, it facilitates project forecasting, which in turn aids managers in making appropriate adjustments. The technique gives an insight into the evaluation and tracking of a project's physical accomplishment by merging

the technical performance requirements, schedule requirements, and financial requirements of a project into a contract [3].

The origins of EVM could be dated to the late 1800s, when industrial engineers began using simple versions of the concept in factories [4]. Although everyone seems to be aware of Earned Value Management, but few are willing to discuss or execute it. Geneste [5] stated that it was possible to draw a direct connection between earned value management and the usage of incentive pay programs and scheduling, both of which go back a very long way in history. Because of this, the insights that were made and the many different shifts that occurred throughout scheduling history are inextricably linked to the development of Earned Value Management. The US Department of Defense was responsible for first implementing Earned Value Management in the US federal government, back in the 1960s. Originally, this idea was known as the Cost/Schedule Control Systems Criteria (CSCSC). Other names for it include earned value management, performance measurement, factory industrial standards, Planned Value of Work Accomplished (PVWA), Budgeted Costs of Work Performed (BCWP), and Cost Schedule Planning Control Specification (C/SPCS). Just the standards, PERT/Costs, and numerous more factors [2]. According to Quentin and Joel [2], the United States Air Force employed the Earned Value Method during developing the Minuteman missile program in the early 1960s. It's common knowledge that the Minuteman project wasn't your typical undertaking. Rather, it was an undertaking involving the most advanced technology, millions of money, and years to finish, and was extremely complicated. In the year 2020, the National Park Service of the United States of America referred to it as a "technological wonder."

The United States Air Force set out to design the specifications for their new management system with the intention of maintaining the concept as an ongoing project management technique. This was the primary motivation behind their decision. They came up with a concept that would later be known as the Cost/Schedule Control Systems Criteria, or CISCSC for short. The C/SCSC was essentially a project management system that consisted of 35 specific criteria that had to be completed for one to make use of the idea. Large-scale government projects in the United States and other nations were mandated to adhere to C/SCSC, but the standard's adoption for private sector work was exceedingly low. It is not as if the project management team was trying to stop the idea from progressing. Instead, most projects found the C/SCSC and its attendant implementation questions to be an unnecessary burden.

In later years, the C/SCSC was modified and eventually superseded by the ANSI-EIA Standard 748 (ANSI-EIA 748), which was published in 1996. This was accomplished through a collaborative effort between the Department of Defense and the private sector. Despite this, there were a total of thirty-two specific criteria and guidelines that needed to be satisfied. There is a good chance that the ANSI-EIA 748 is the ideal standard for a project of the Minuteman variety, with all its myriad complications.

According to the authors, Quentin and Joel [2] however, this approach is probably way too prescriptive for most normal tasks.

After that, the PMI published their PMBOK Guide the next year in 1996. The PMBOK® Guide outlines several fundamental needs that must be met before earned value can be calculated. These requirements include defining the project, planning, and scheduling the project, adding resources, and so on. As a result, the PMBOK® Guide constitutes the barebones minimum earned value standard that can be applied to every project. In addition, the ANSI-EIA 748 standard is still the criterion that should be followed for projects that are larger and more complicated. Both concepts are compatible with one another. According to Bryde *et al.* [6], earned value management comes into play to answer the challenges posed from cost and schedule. In this scenario, the data based on cost might reveal that Over budget expenses are incurred by the project, but without making the difficult and complicated cross-referencing to the time-based data. It is possible that the project is going to have difficulties staying under its allotted spending limit because the work that was scheduled to be done was finished according to plan, but it ended up costing more than what was first predicted. Alternately, it is having problems keeping to the timeline, it would imply that although the expense estimates were correct, less work was completed than anticipated. This would indicate that the situation is problematic. Attempting to understand the causes for and the implications on the budget of a lack of progress against the timetable, confusion can occur because there is a lack of progress against the schedule. One of the most important factors in being an efficient organization is having a performance measurement system (PMS) that works well. One system would handle the finances, while the other managed the schedule; these two components have traditionally been kept apart from one another in a PMS. As part of its mandated approach to planning and managing, the US Air Force later directed in 1966 that earned value management techniques be used for all of its program. The concept of earned value management is currently being used in projects all over the world. It has become a requirement of many agencies within the

United States Government. England and other countries in Europe, China, Japan, Canada, and Australia are among the most prominent adopters of EVM. Multiple firms, universities, and consultancies, as well as the US Government Accountability Office (GAO) and the Office of Management and Budget (OMB), support the use of EVMs. Major users of the term include the Defense Acquisition University, the National Aeronautics and Space Administration (NASA), the Project Management Institute (PMI), and Acquisition Management (UK) [5].

There is not much research about earned value management in Nigeria. Despite its proven efficiency, not many construction professionals in Nigeria use it or believe it even works [7]. Omoregie and Radford [8], in their research found that the poor adoption of EVM in Nigeria can be attributed to inadequate knowledge of Earned Value Management, government policy, unstable economy etc. The involvement of professionals in most cases ends at the pre-contract phase, some of the reasons is the belief of the client that the contractor is well equipped to carry on without the consultants. The project stakeholders' limited experience in the construction management field, fixed contract prices, scope changes, costs incurred from implementation of the

control technique and variances occurring during the construction stage were discussed by Mortaji *et al.* [9] as contributors in preventing the implementation of EVM as a control technique. Some of the barriers hindering EVM use in other developing countries include issues like lack of properly trained personnel, lack of support from upper management, among others listed below along with suggested remedies. Soltan and Ashrafi [10], presented a strategy for forecasting project duration, cost and selection of best action plan. Planning and controlling issues in project management were stated to be generally the most essential issues which posed numerous effects on different fields of projects, such as lowering the project duration and cost [10]. According to the authors, one of the greatest concerns of project managers have always been concerned with tracking project progress, evaluating project performance, and comparing results to a baseline. They added that managers are enthusiastic about finding simple ways to denote project performance and one of the most effective project management methods was the earned value management method [10]. It was stated that this technique was originally applied in 1960 and that the US defense industry urged the use of it for financial analysis. After being applied to financial control and analysis for seven years, the procedure was standardized, expanded, and renamed.

To increase accuracy of their project, Soltan and Ashrafi [10] used control charts alongside the earned value management method and argued that this model can be applied in each project phase separately to provide the possibility of selecting the best action plan to improve project performance. They also used a case study to investigate the effectiveness of the proposed method.

The authors provided an impressive summary of a stream of research which was conducted to understand the earned value management from various perspectives in recent years solely because EVM was of the vital components of project management and control. The papers are:

1. Leu and Lin [11]: set up individual control charts for CPI and CPI-1 to evaluate project performance.
2. Hunter *et al.* [12]: focused on the implementation of earned value management method on RBSP projects. It further examined the benefits of the method to shed light into cost/benefits for putting the method into practice.
3. Mortaji *et al.* [9]: used change point analysis to extend a relatively reliable cost and performance indicators. They demonstrated how the model could be applied to get more precise estimations for the project's total cost and duration.
4. Chen *et al.* [13]: proposed a method for improving the predictive power of planned value and developed the model for four case projects.
5. Baqerin *et al.* [14]: presented a model to conduct an estimate of schedule performance. In order to predict schedule performance, their model focused on the recurring nature of the main activities.
6. Khamooshi and Golafshani [15]: developed a method that decoupled schedule and cost performance measures. They also introduced new metrics that have wide applications to measure schedule performance.

Soltan and Ashrafi [10] criticized that the literatures in all the research listed above only focused on the use of the earned value management approach to control and predict the status of projects and this could be erroneous considering project risks. They also explored a static approach to forecast the final state of the project and focused on the estimation while leaving out the selection of an action plan and thus, the aim of their paper (Predicting Project Duration and Cost, Using Statistical Methods), was to offer a method to project duration and cost estimation as well as the best action plan selection using statistical methods. They claimed that their suggested approach would provide a confidence interval to predict project duration and cost in each phase, suggest the best action plan using professional opinion and since the proposed approach was to be used in each phase separately, the accuracy of this it was predicted to be higher.

The feasibility of the suggested method was validated when the initial prediction for the project's duration and cost were presented and found to be within the prediction interval. Optimistic and pessimistic projections were computed for these variables. The approximated cost of the project was less than the total budget of the project which established the project to be satisfactory in terms of cost. However, the predicted interval for duration was greater than the actual completion duration and the project was concluded to likely take longer than the projected duration.

Some of the main advantages of the proposed method in the present paper are as follow:

First, the increased accuracy of the model in project duration and cost prediction was verified by using control charts for the relevant indicators in the suggested method. Second, the model offered the probability of choosing the optimal course of action to manage and enhance project performance. Third, the independent application of the method in each phase also lead to an increase in the accuracy of the model.

The main limitation was stated to be the unfeasibility of sensitivity analysis and suggested that future research be made to overcome the encountered limitation using a mathematical model to integrate forecasting the final state of the project and selecting the best action plan [10].

### 1.1 Statement of problem

Despite the fact that Nigeria is still a developing nation, it has a large number of existing and proposed new projects across the 36 states of the Federation and Federal capital territory. According to Deloitte [16], the construction industry has experienced tremendous expansion in Africa with Nigeria hosting 36% which cost over 62.2 billion US dollars. A project's complexity raises the probability of unforeseen risks. But these risks are by no means the only issues facing Nigeria's construction sector. Ezeokoli *et al.* [17] have pointed out the that Nigeria construction is confronted with the following challenges that include, but are not limited to scope creep, cost overruns, poor quality control, poor planning, poor management, poor funding and corruption. Effective management of building projects has the ability to benefit the country's economy overall because the construction industry significantly contributes to the

strength and expansion of the economy. This the reason while management of construction projects has a great degree of significance. The earned value methodology is a useful tool for managing of project scope, cost, and time. It forecasts the future based on planned and actual values, allowing project managers to adjust as necessary. One of the many advantages of the earned value management approach is its capacity to forecast project conditions and control project status There few construction firms in Nigeria that adopt use of this method despite its proven efficiency, therefore the significance of this research. Part of the objectives this research is to propose a strategy for estimating project duration and cost as well as choosing the most appropriate course of action. Control charts are used in conjunction with the earned value management approach to improve accuracy.

## 1.2 Significance of the research

Since there aren't many research topics covering this area in Nigeria, according to Anukwe [7], also in the cause of this study, it was discovered that there is no previous research on the Utilization of EVM on Roads and Bridges construction in Nigeria. The information gathered from this study can be used by academics and practitioners to carry out more in-depth research in the field and increase general knowledge about the practice. This is why the study is significant. The result of this study will help improve project management in the future and inspire the project management community to reconsider and enhance the methods in which the government uses EVM and project management. Furthermore, earned value management is not commonly used or performed, especially in developing countries like Nigeria. Despite its shown efficacy, the procedure is still applied at a comparatively low rate. This study will throw more light on the effectiveness of the technique and how to apply it success fully in a project hence its significance

## 2.0 Materials and Methods

The study research employed a survey using questionnaires, interviews for data collection. The questionnaires were aimed at getting an in-depth knowledge of EVM in Nigeria. Also, a case study design was employed whereby Ibi Bridge project was used as a sample to collect data. The data were processed using Microsoft Excel, ANOVA, and Earned Value Analysis (EVA) were used to analyze the data

### 2.1 Population of the study

The population for the study comprises professionals working in construction companies in Abuja, Nigeria. A case study Ibi Bridge project was used. This includes individuals across various job levels and roles. The study aims to capture a diverse representation of professional. The total sample size for this study is 150. The sampling procedure of this study was a stratified random sampling procedure, which is a type of probability sampling procedure that involves dividing the population into homogeneous subgroups (strata) and then selecting a random sample from each subgroup.

### 2.2 Method of data analysis

The analysis of case study was done with the aid of Microsoft Project professional 2016 while the data obtained from the interviews was analyzed using content analysis (summary) method.

## 3.0 Results and Discussion

### 3.1 Assessment of the level of awareness.

The results and findings of the assessment of the level of awareness is shown in Table 1. The results clearly show that the majority of the respondents that is 47 (66.2%) were not aware of the Earned Value management system, and 24 (33.8%) respondents were aware. There was no respondent who responded that was not sure.

**Table 1: Level of Awareness of Respondents on Earned Value Management (EVM) Sample Awareness of EVM**

Sample	Awareness of EVM			Total
	Yes	No	Not Sure	
Engineer	13	34	0	47
Architect	7	8	0	15
Builder	2	5	0	7
Quantity surveyor	2	0	0	2
Total	24	47	0	71
Percentage	33.8%	66.2%	0	100%

### 3.2 Source of knowledge for awareness of earned value management (EVM)

Measuring the respondents' sources of Earned Value Management System (EVM) skills and knowledge was crucial. Only one information source; formal training from universities and short courses was mentioned in the results and findings, accounting for 79% of the data. Nevertheless, 21% of the respondents used EVM by following project managers' instructions, while the remaining respondents did not have the opportunity to apply it.

### 3.3 Level and skills of respondents

The results and findings of the level and skills of respondents is shown in Table 2. The results and conclusions show that while there is a low degree of awareness, there is a high level of project management (EVM) skills. They are indirectly practicing part of EVM. In this research, 64 respondents (90.14%) shows that they understood the objective of the projects in which they are working on. In addition, 63 respondents (88.7%) stated that the work breakdown structure (WBS) was used by the project team to determine the scope of work. Also, 65 respondents (91.5%) agreed that project managers assigned the responsibility for each team member for the implementation of each task on project. furthermore, 57 respondents (80.3%) agreed with the project team which established project cost, and time baseline. nonetheless, 17 (29.58%) and 24 (33.8%) respondents stated that there was great interest on knowledge of project performance

analysis including computations using EVA and the use of Project Management Software for monitoring the project respectively.

**Table 2: The Level of Skill on EVM to the Respondent**

The level of skills/ knowledge of EVM to the key players	very high	High	moderate	low
1 Project team understands the objective of the projects in which they participate	26	38	6	1
2 The project team establishes the scopes of works using WBS	24	39	6	2
3 P.M assigns the responsibilities for each person for implementation of the particular task	40	25	4	2
4 Estimation of costs for resources and schedule for baselines and tools used for schedule cost	32	25	8	6
5 Calculation for performance analysis (schedule and cost variance) from the baselines for more decision	11	10	23	28
6 The use of different PM software on monitoring the project	10	14	23	24

**3.4 Factors that hinder and enhance the effective application of EVM**

The major threat to the deployment of EVM, according to Tables 3 and 4 results and findings, is as follows:

- i. Of the 53 responders, (74.6%) agreed with the degree of experience and expertise.
- ii. 57 respondents (80.3%) attribute it to lack of adequate research and development
- iii. 61 respondent (85.9%) were level of political interference and corruption
- iv. In contrast, 56 (90%) respondents mention regulations and construction industry standards
- v. 86 responders (53%), mentioned the absence of top management support.
- vi. In contrast, 47 respondents cited inadequate time and poor financial planning.

We can mitigate these threats by using project management experts, having top management support and commit to using EVA, allocating sufficient resources and budgets, using tools for planning and monitoring project scope, cost, and time, adopting the EVM construction industry standard, and using various project management software to monitor the project.

**Table 3: Factors which hinder the effective application of EVM**

Factors that will hinder the effective application of EVM	very high	High	moderate	Low
1 Level of professional and Experience	24	29	15	6
2 Lack of adequate research and development	24	33	13	2
3 Political interference and Corruption	33	28	4	6
4 Regulation and Industrial standard	38	26	4	3
5 Lack of top management support	33	27	4	7
6 Poor financial planning and time estimations	24	36	8	3

**Table 4: Factors that will enhance the Effective Application of EVM**

Factors that will enhance the effective application of EVM	very high	High	moderate	low
1 Expertise of project management staff	32	24	9	6
2 Top management support	36	21	9	5
3 Well allocation resources and budget	30	20	13	8
4 Use tools for planning, and monitoring of project	34	21	9	7
5 Adoption of EVM industry standard	34	23	8	6
6 The use of PM Software	40	25	4	2

**3.5 Construction project performance using Earned Value Analysis (EVA) in Nigeria**

This analysis reveals the efficiency at which the work was done and the rate at which it was completed. It also displays the expected increase in profit or decrease in profit over the initial plan that the consultants, contractors, or clients are likely to experience. The cumulative projected Value (PV) is determined

based on the analysis and the projected profit and loss sheet created prior to the start of the project. Additionally, the percentage completion is estimated from the actual work completed. The Earned Value (EV) is computed by multiplying from the percent completed and PV. The actual expenditure for the work done at a given point is acquired. This is called the Actual Cost (AC). Based on these three parameters the EVA derived performance metrics are computed.

### 3.6 Case study analysis

The case study was carried out on a construction of Ibi Bridge over River Benue. The project was conceived by the Federal Ministry of works as part of the Federal Ministry works ongoing projects. The contractor was awarded on 27<sup>th</sup> August 2018 with the Engineer’s order to commence work on 10<sup>th</sup> December, 2018 and complete same on 9<sup>th</sup> August, 2023. The scope of works involves the construction of a 2.4km length Bridge with the width of 11.6m and 8km road. The budgeted cost of the project is ₦57,070,626,291.11. The project information, which includes costs, resources and schedule, were obtained through interviews with the construction firm and the project was then created in Microsoft Office Project Professional 2016. A Work Breakdown Structure was created and resources were assigned to the tasks with the appropriate quantities. Next, the project start date (10<sup>th</sup> December, 2018) and end date (9<sup>th</sup> August, 2023) were inputted. Progress was recorded up to August 2023 and a baseline was saved for the earned value analysis. Following 56 months of work, the project was assessed to have completed 33.56% of its target,

### 3.7 Earned value analysis of case study

From the project status taken in August 2023 the project was recording 33.56% on overall completion status; however, there were delays on most tasks. Aside from tasks that had not yet started as of status date, progress had been affected and the project is behind schedule.

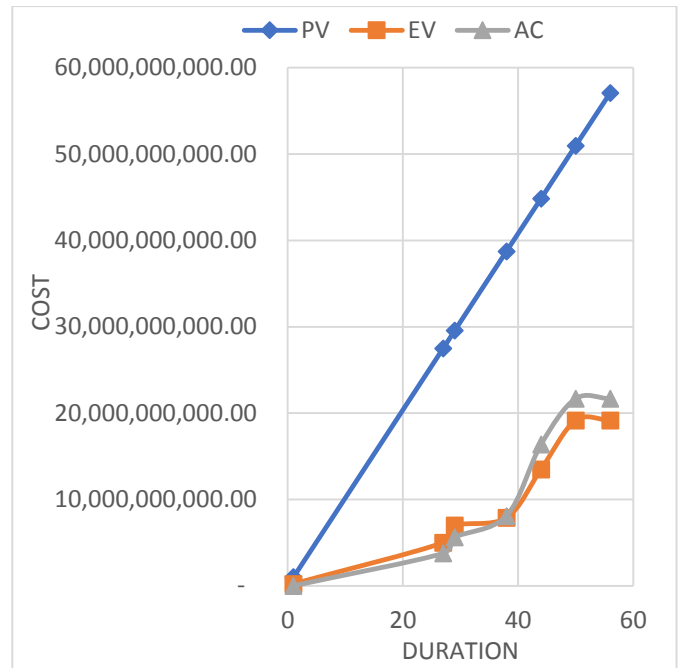
- I. The table below shows the values of EVM parameters recorded, from here it can be concluded that the project is running 66.44% behind schedule.
- II. The planned value or budgeted cost for work done until status date is ₦57,070,626,291.11) and is more than the earned value, which confirms that there are still unfinished tasks.

**Table 5: Earned Value Analysis of Activities Done for the 59 Months**

Metric Definition	Value (NGN)/Ratio
A: Cumulative PV	NGN 57,070,626,291.11
B: % Completion	33.56%
Cumulative EV = A x B	NGN 19,152,902,183.29
Cumulative Actual Cost (AC)	NGN 19,112,736,936.35

The Figure below is the graphical representation of actual cost, planned value and earned value, as explained earlier the

actual cost is lower than the planned value meaning that the project is under budget.



**Figure 1:** Graphical representation of Planned Value (PV), Earned Value (EV) and Actual Cost (AC) for Ibi Bridge Project in Nigeria

**Table 6:** Earned Value (EV) Performance

Metric Definition	Value (NGN)/Ratio
CV= BCWP – ACWP	-2,511,058,307.32 (NGN)
SV = BCWP – BCWS	-37,917,724,107.8 (NGN)
CPI=BCWP ÷ ACWP	0.88
SPI=BCWP ÷ BCWS	0.34
EAC= BAC ÷ CPI	64,852,984,421.71 (NGN)
ETC = EAC - AC	45,700,082,238.42 (NGN)
VAC = BAC - EAC	7,782,358,130.6 (NGN)
EAT= ETC ÷ SPI	164.71
CR = CPI × SPI	0.30

According to EVA analysis, this project has unfavorable Cost Variance (CV) = -2,511,058,307.32 (negative number) and Cost Performance Index (CPI) = 0.88 < 1. This indicates that the project's budget exceeds the amount of work completed. Additionally, the project's Schedule Performance Index (SPI) is 0.34 < 1, and its unfavorable Schedule Variance (SV) = -37,917,724,107.8 is a negative figure. This indicates a delay in the project's timeline. The critical ratio (CR) for the project is 0.30 < 1, It is clear that the project has not been handled to the anticipated level of performance. This project is expected to be completed in 164.71 months, not the 56 months that were originally anticipated (nearly three times the intended period), according to the results of the EVA analysis. When this project is completed, the projected cost will be NGN 64,852,984,421.71

### 3.8 Variances

The schedule and cost variances are shown in the figure below. From the analysis, the cost variance (CV) is - ₦2,511,058,307.32 and the percentage cost variance -13%. This means that there is cost overrun, The schedule variance has a value of - ₦37,917,724,107.8 which expressed in percentage is -66% (SV%). This indicate that the project is running behind schedule.

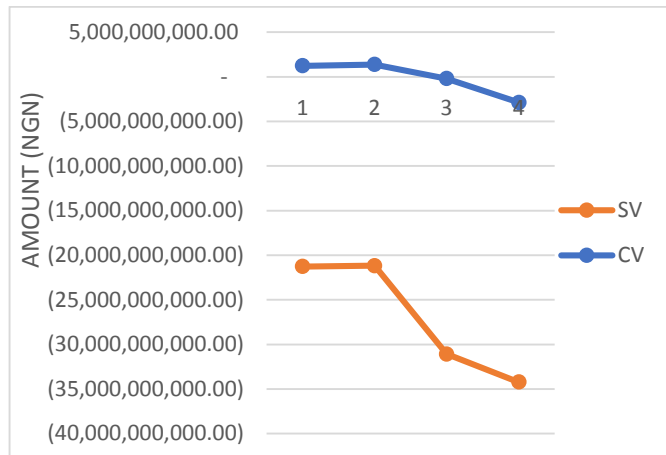


Figure 2: Graphical Representation of SV and CV

### 3.9 Indices

The schedule performance index and cost performance index report 0.88 and 0.34 respectively. For the CPI and SPI, values below 1 show a negative performance while values above 1 show good performance

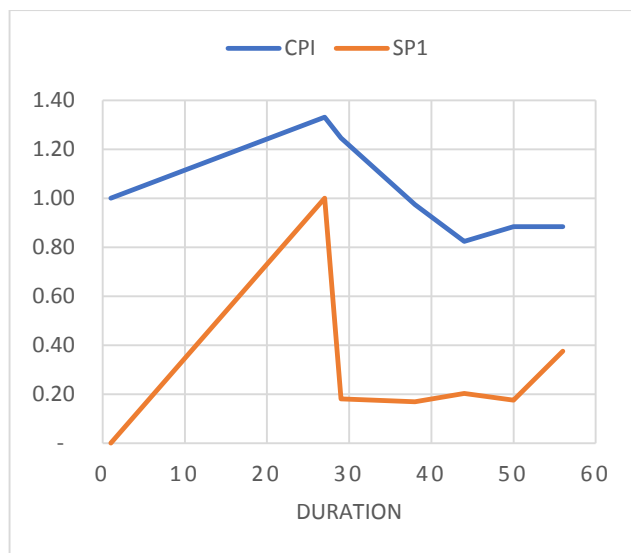


Figure 3: Graphical representation of CPI and SPI

### 3.10 Forecasting

The ETC (Estimate to Complete) represents remaining costs from the status date to the project completion date is ₦45,700,082,238.42, assuming all conditions remain the same. The VAC (Variance at Completion) indicates the cost overruns

expected at the end of the project. In this case, it is ₦7,782,358,130.6 meaning the project completion cost will be higher than planned. The cost estimate at completion (EAC) of this project is forecasted to be NGN 64,852,984,421.71

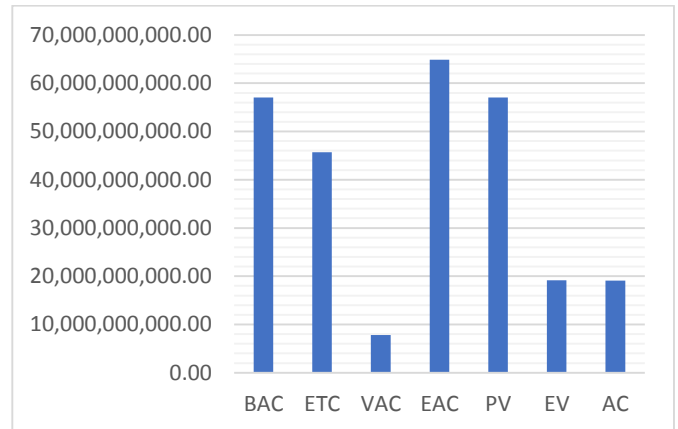


Figure 4: Graphical Representation of Forecasting Indices

The analysis has shown that the Project manager needs to complete the unfinished tasks and close the gap in the schedule. Although this delay has affected the overall progress of the project as at the time of doing the analysis, which already have an impact on the cost because additional man-hours will be spent to increase the work rate and get the project back on track

### 3.11 Summary of Findings

The purpose of this study was to evaluate the Nigerian construction project practitioners' knowledge and proficiency with the Earned Value Management System (EVMS). It was shown that most professionals in the construction industry were not aware of the Earned Value analysis methods available for tracking project performance. It is noteworthy, therefore, that a small number of practitioners in the construction sector are still in the early stages of implementing certain EVMS components, such as Work Breakdown Structure (WBS) it may also be said that the project team members had very high understanding of the project goals. Project teams also had solid understanding of the project scoping such as WBS and there was clear delegation of duties among the technical team members which are part of important elements for implementation of EVMS. It is noteworthy that in Nigeria construction industry, the estimation for resource is properly done during planning phases of construction projects.

Prior to the project contract being signed, the project timeline and cost baselines are established. The fact that the respondents gave this technique an extremely high ranking attested to this. The study did find, however, that Nigeria was still a developing country when it came to the usage of project management tools like project management software, which might improve the use of EVMS in construction projects. Earned Value Management (EVM) implementation in Nigerian construction projects is influenced by various factors such as insufficient research and development, political interference and corruption, industry standards and regulations, insufficient support from upper

management, and subpar financial and time estimations. However, top management's support for the EVM's deployment in Nigeria is insufficient, which has a negative impact on projects. The conclusions from each of the four scenarios have demonstrated that there was an issue with the project's underperformance, either because it was going over budget or because it took a long time to finish. According to the study, in order to improve project performance, the Nigerian construction industry must adopt EVM. This will support the use of professional tools, increased accountabilities, project monitoring and assessment, and appropriate project performance reviews. EVM is a comprehensive method that incorporates scope, schedule, and cost measurement. With the appropriate usage of EVMS, it is simpler to execute and track the project status and performance in order to identify any trends in the variance between the initial intended budget and the actual budget. Any stage of the construction project, can benefit from the use of the EVMS to forecast time and cost estimations after completion. The project managers will receive information or early warning signals from this, which will persuade them to take the necessary corrective action.

#### 4.0 Conclusion and Recommendation

##### 4.1 Conclusion

Based on the findings of this research work, it is apparent to illustrate the effectiveness of earned value management, the case study focuses on its implementation. Even though the project that formed the foundation of the case study is still ongoing, all of the reports produced thus far have indicated that the project is lagging behind schedule and that there has been some fluctuation in the CPI. If certain decisions are not taken and activity delays are not corrected, the project could take up to 164.7 months, given its current pace and the SPI results. By improving communication and lowering the possibility of risk, a project manager who uses Value Management more frequently can increase team productivity and improving tracking accuracy, forecast liability, reporting clarity, and reporting precision. By providing regular updates on the project's progress, Earned Value Management helps clients stay informed and make well-informed decisions. It would now be left for the client and contractor to choose the best course of action for the project moving forward.

##### 4.2 Recommendation

These results lead to the following suggestions being made: Researchers, professors, and influential members of the construction industry must step in to carry out scientific investigations into additional elements that either impede or promote the performance of project management in the public and private domains. Additionally, a study comparing the performance of domestic and foreign enterprises in project management should be carried out. These empirical studies will provide a clear picture to all stakeholders, clients, designers, contractors, users, financiers, and donors on how to mitigate or reduce project failures.

There is a need of institutionalizing effective project management practice and make proper use of Earned Value

Management System in construction industry in Nigeria. Ministries, Departments and Agencies dealing with construction projects in Nigeria should establish proper departments or units for construction projects/programs managements. This will help to provide substantive professional project management for the national and state construction project planning, execution, monitoring and control and close out.

Nigeria's construction sector is governed by insufficient norms and laws for construction project management. The development or adoption of suitable standard tools and regulations for the planning, designing, and management of construction projects is suggested for the Nigerian government. This will offer construction project managers boundaries, guidelines, uniformity, and unified approaches, as well as appropriate coordination of project scope, schedule, and cost objectives. In Nigeria, training on the use of EVMS is required for professionals involved in construction projects, including engineers, architects, quantity surveyors, and associated specialists. To improve skills, knowledge, competence, honesty, responsibility, self-regulation, and solve construction project management issues, this should be done in tandem with ongoing professional development seminars and trainings for important private and public construction project stakeholders. The study shows that there is a problem of delays and cost overruns during project implementation which partly are attributed by scope of design changes. The researcher suggests that all relevant stakeholders from all decision-making levels—political, senior staff, professionals, and the general public—be included in the development of project ideas at the proper project planning phases in order to fulfill all of the demands of the particular target groups. This will minimize the risk of expensive changes during project execution, delay, reworks, cost overruns, schedule overruns, and project failures.

##### 4.3 Suggestion for further study

The contribution of this research to body of knowledge can be summarize as follows:

- i. The research shows how EVM was used to provide a structured approach to measuring project performance by comparing the value of work actually performed to the budget and schedule in real time. This allows project managers to assess performance against the base line and make data – driven decision to keep the project on track.
- ii. The research shows how EVM was use to provide comprehensive view of project health by identify cost and schedule variances early, allowing for proactive management of project resources and effort.
- iii. From the case study, It be clearly seen how EVA was used to generate data for decision making, which can be use by project managers and stakeholders to evaluate the impact of changes, forecast final project costs and timelines, and make informed decision to optimize project outcome.
- iv. It was found that the majority of construction practitioners in Nigeria were unaware of the Earned Value analysis tools for monitoring the performance of construction projects.



- v. The study shows the problem of delays and cost overruns during project implementation can be solved by effective implementation of EVA.
- vi. The case study of this research, which is on a project with long duration (Bridge construction), allow the earned value analysis progress for a longer period and generate more in-depth results.

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